Topic: Logarithmic derivatives

Question: Find the derivative of the logarithmic function.

$$y = \ln\left(x^2 - 5x\right)$$

Answer choices:

A $y' = \dfrac{2x + 5}{x^2 + 5x}$

B $y' = \dfrac{2x - 5}{x^2 - 5}$

C $y' = \dfrac{5 - 2x}{x^2 - 5x}$

D $y' = \dfrac{2x - 5}{x^2 - 5x}$

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Solution: D

Using chain rule to take the derivative, we'll substitute, letting $u = x^2 - 5x$ and $u' = 2x - 5$. We get

$$y = \ln u$$

$$y' = \frac{1}{u} \cdot u'$$

$$y' = \frac{1}{x^2 - 5x} \cdot (2x - 5)$$

$$y' = \frac{2x - 5}{x^2 - 5x}$$

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Topic: Logarithmic derivatives

Question: Find the derivative of the logarithmic function.

$$y = \ln \sqrt[3]{2x^3 - 5}$$

Answer choices:

A $y' = \dfrac{2x}{2x^3 - 5}$

B $y' = \dfrac{x^2}{2x^3 - 5}$

C $y' = \dfrac{2x^2}{2x^3 + 5}$

D $y' = \dfrac{2x^2}{2x^3 - 5}$

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Solution: D

Let

$$u = \sqrt[3]{2x^3 - 5} = \left(2x^3 - 5\right)^{\frac{1}{3}}$$

and

$$u' = \frac{1}{3}\left(2x^3 - 5\right)^{-\frac{2}{3}}\left(6x^2\right)$$

$$u' = \frac{2x^2}{\left(2x^3 - 5\right)^{\frac{2}{3}}}$$

Then

$$y = \ln u$$

and

$$y' = \frac{1}{u} \cdot u'$$

Plugging back in for u and u', we get

$$y' = \frac{1}{\left(2x^3 - 5\right)^{\frac{1}{3}}} \cdot \frac{2x^2}{\left(2x^3 - 5\right)^{\frac{2}{3}}}$$

$$y' = \frac{2x^2}{\left(2x^3 - 5\right)^{\frac{1}{3}}\left(2x^3 - 5\right)^{\frac{2}{3}}}$$

$$y' = \frac{2x^2}{\left(2x^3 - 5\right)^{\frac{1}{3}+\frac{2}{3}}}$$

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$$y' = \frac{2x^2}{2x^3 - 5}$$

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Topic: Logarithmic derivatives

Question: Find the derivative of the logarithmic function.

$$f(x) = 4\ln(x)$$

Answer choices:

A $f'(x) = \frac{4}{x}$

B $f'(x) = 4x$

C $f'(x) = 4$

D $f'(x) = x$

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Solution: A

The derivative of $\ln x$ is given by

$$\frac{d}{dx}\ln x = \frac{1}{x}$$

So the derivative of the given function

$$f(x) = 4\ln(x)$$

is

$$f'(x) = (4)\frac{1}{x}$$

$$f'(x) = \frac{4}{x}$$

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